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Windmill pn-sequence generators

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Abstract:

A windmill generator is a high-speed sequence generator capable of producing blocks of v consecutive symbols in parallel. It consists of v feedback-shift registers linked into a ring. The sequences are identical to those produced by a linear feedback-shift register with feedback polynomial of the special ('windmill') form $f(t) = \alpha(t^v) - t^L \beta(t^{-v})$, where $\alpha(t)$ and $\beta(t)$ are polynomials of degree less than L/v . L (relatively prime to v) is the degree of the polynomial, and is also the sum of the lengths of the registers making up the windmill. The connections of the windmill generator are directly specified by the coefficients of $\alpha(t)$ and $\beta(t)$. The polynomial $f(t)$ must be primitive if the output sequence is to be of maximal period. The authors have devised a search for windmill polynomials over the binary field that can generate sequences of period $2^L - 1$ in blocks of size $v = 4, 8$, and 16 , for L ranging over the odd values from 7 to 127 . When $L \equiv \pm 3 \pmod{8}$, no irreducible windmill polynomials at all were found. For the other odd values of L , primitive windmill polynomials seem to occur about twice as frequently as would be expected from probabilistic considerations, so that they are in fact very common. For such values of L , roughly $2/L$ of all windmill polynomials with given v appear to be primitive.

Index Terms:

feedback polynomials random number generation shift registers binary field consecutive symbols feedback polynomial feedback-shift registers windmill pn-sequence generators

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